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PACKING CONTAINER FOR PASTEURIZING

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Claim

A type of packing container for pasteurizing characterized by the fact that it is made of a compound consisting of crystalline propylene homopolymer, ethylene-propylene block copolymer, and mica.

Detailed explanation of the invention

This invention pertains to a type of packing container for pasteurizing. More specifically, this invention pertains to a type of packing container for pasteurizing characterized by the fact that it has good properties, such as rigidity, impact strength, heat resistance, cold resistance, ease of processing, ease of sealing, and other properties required for a packing container for pasteurizing, in particular, sufficient effect of preventing oxygen permeation.

According to this invention, the packing container for pasteurizing refers to a type of packing container into which contents are filled and then its opening portion is sealed, followed by pasteurizing at high temperature and high pressure.

Polypropylene of the prior art has high heat resistance, good transparency, is harmless, and has high chemical resistance. Due to these excellent properties, it is used in manufacturing packing containers for foodstuffs, pharmaceuticals, etc.

However, polypropylene has a disadvantage with respect to its ability to prevent oxygen permeation. Consequently, when a container made of polypropylene is brought in contact with oxygen, degradation in quality takes place easily, thus it is inappropriate for use as packing containers for foodstuffs and pharmaceuticals.

A polymer composition having improved mechanical properties has been proposed. This polymer composition is made of a mixture of prescribed amounts of three components, that is, polypropylene, hydrocarbon rubber-like elastomer, and mica. However, it is irrelevant to the property of oxygen permeation barrier.

In addition, for the proposed composition, sericite in high purity is added to polypropylene to improve the heat resistance, weatherability, and chemical resistance of polypropylene. However, even in this case, it is still impossible to prevent oxygen permeation.

As a result of extensive studies made by the present inventors on development of a type of packing container for pasteurizing that is based on polypropylene and can sufficiently prevent oxygen permeation while maintaining various characteristics for use as a packing container for pasteurizing, e.g., rigidity, impact strength, heat resistance, cold resistance, ease of processing, ease of sealing, etc., it was found that the aforementioned objective can be realized by using a

type of compound consisting of crystalline propylene homopolymer as well as ethylene-propylene copolymer and mica.

That is, this invention provides a type of packing container for pasteurizing characterized by the fact that it is made of a compound consisting of crystalline propylene homopolymer, ethylene-propylene copolymer and mica.

The crystalline propylene homopolymer used in this invention is an isotactic polypropylene having a high isotactic index. For example, the type with physical properties of, e.g., molecular weight in the range of 250,000-400,000, melt-flow index in the range of 0.5-7, Vicat softening point in the range of 145-155°C, and thermal deformation temperature in the range of 112-120°C, may be used preferably.

The type of ethylene-propylene block copolymer used in this invention is preferably of the type having the following physical properties: ethylene content in the range of 2-15 wt%, melt-flow index in the range of 1.0-8, Vicat softening point in the range of 130-145°C, thermal deformation temperature in the range of 105-115°C, brittle point in the range of -5 ~ -30°C.

Examples of mica that may be used in this invention include muscovite, red mica, soda mica, sericite, roscoelite, illite, and other muscovite-based mica, as well as biotite, phlogopite, ferruginous mica, zinnwaldite, and other biotite-based mica.

According to this invention, it is preferred that mica with a high purity be used. The higher the purity of the mica, the better the effect of preventing oxygen permeation. In particular, mica with average particle size in the range of 100-325 μm is preferred.

As explained above, the compound for packing container for pasteurizing is made of three components. As far as the composition of the compound is concerned, the proportion of propylene homopolymer should be in the range of 10-90 wt%, or preferably in the range of 30-50 wt%; the proportion of the crystalline ethylene-propylene block copolymer should be in the range of 10-80 wt%, or preferably in the range of 20-40 wt%; the proportion of mica should be in the range of 10-50 wt%, or preferably in the range of 20-40 wt%. For this compound, if the proportion of the crystalline propylene homopolymer is less than 10 wt%, the resistance to oxygen permeation, thermal deformation temperature, and Vicat softening point will be degraded, and this is undesired. If the proportion of the ethylene-propylene block copolymer is less than 10 wt%, the impact strength will decrease, and this is undesired. On the other hand, if the proportion of the ethylene-propylene block copolymer is more than 80 wt%, the resistance to oxygen permeation will decrease. This is undesired. If the proportion of mica is less than 10 wt%, the effect of preventing oxygen permeation will decrease, and this is undesired. On the other hand, if it is over 50 wt%, the impact strength will increase, and this is undesired. As the amount of mica added (wt%) increases in the range of 10-50 wt%, the resistance to oxygen permeation rises.

The compound for forming the packing container for pasteurizing of this invention may be prepared as follows: The three components, that is, crystalline polypropylene, ethylene-propylene block copolymer, and mica, are mixed by a Henschel mixer, and the mixture is blended and melted using a vent extruder under heating condition of 160-240°C, followed by pelletization.

According to this invention, the packing container for pasteurizing is manufactured from the aforementioned blend. When the packing container is [manufactured as] a container, the blend is extruded and molded at 160-240°C using an injection molding system, hollow molding system, or other device. When the packing container is [manufactured as] a film sheet, the blend is extruded and molded at 160-240°C using a device of any of the following systems: blow extrusion system, calendering extrusion system, T-die extrusion system, etc.

For the compound of the this invention, the aforementioned three components are required. In addition, one may add a polybutene-based material to improve the compatibility between mica and polypropylene when they are blended, so as to increase the impact strength.

In the following, comparative tests and their results will be shown to illustrate why said three components are necessary for forming the packing container for pasteurizing of this invention.

Comparative tests and results

(1) Method of experiment

The following six samples were prepared.

1) Crystalline propylene homopolymer

2) Ethylene-propylene block copolymer

3) Mixture composed of 50 wt% of crystalline propylene homopolymer and 50 wt% of COPP

4) Compound composed of 70 wt% of crystalline propylene homopolymer and 30 wt% of 325-mesh sericite

5) Compound composed of 70 wt% of ethylene-propylene block copolymer and 30 wt% of 325-mesh sericite

6) Compound composed of 35 wt% of crystalline propylene homopolymer, 35 wt% of ethylene-propylene block copolymer and 30 wt% of 325-mesh sericite

For the above six samples, the dart impact value, Vicat softening point, and oxygen permeability were measured using the following test methods.

(A) Test for measurement of dart impact value

This test was performed according to ASTM-D-1709 (from a height of 60 in). It is in units of °C.

(B) Test for measurement of Vicat softening point

This test was performed according to ASTM-D-1525. It is in units of °C.

(C) Test for measurement of oxygen permeability

This test was performed according to ASTM-D-1434. It is in units of cc/0.1 mm/m^2/day.

(2) Test results

For the aforementioned six samples, the aforementioned tests were performed, with results listed in the following table.

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Key:
1 Sample No.
2 Dart impact value g
3 Vicat softening point °C
4 Oxygen permeability cc/0.1 mm/m^2/day
5 200 or less

From the results listed in this table, the following conclusions can be drawn.

Compared with the case when crystalline propylene homopolymer alone or ethylene-propylene block copolymer alone is used, when mica is mixed in the crystalline propylene homopolymer and ethylene-propylene block copolymer, respectively, the oxygen permeability decreases, and the gas barrier property is significantly improved. When the three components of crystalline propylene homopolymer, ethylene-propylene block copolymer, and mica are all mixed, the oxygen permeability is further reduced, and the gas barrier property is further improved.

On the other hand, when mica is mixed in the crystalline propylene homopolymer, compared with the case when the crystalline propylene homopolymer is used alone, the dart impact value is smaller. Consequently, the impact strength is lower. However, when ethylene-propylene block copolymer is also added into the two components of crystalline propylene homopolymer and mica, the dart impact strength exceeds that when two components of crystalline propylene homopolymer and mica are used. Consequently, the composition made

of the three components of crystalline propylene homopolymer, ethylene-propylene block copolymer and mica has a high impact strength in the pasteurizing treatment.

Decrease in Vicat softening point due to addition of mica is not so significant. The compound composition made of three components of crystalline propylene homopolymer, ethylene-propylene block copolymer, and mica has a high heat resistance in the pasteurizing treatment.

Consequently, it is possible to obtain a packing container for pasteurizing characterized by the fact that it has excellent gas barrier property, high impact strength, and high heat resistance.

In the following, this invention will be explained in detail with reference to an application example.

With a mixing ratio of 35:35:30 wt%, crystalline polypropylene with density of 0.90 and M.I. of 1.0, commercially available ethylene-propylene block copolymer with density of 0.90 and M.I. of 1.5, and 325-mesh sericite were mixed and uniformly dispersed, followed by blending and pelletization. Then, the pelletized compound was used to form a sheet. Then, the sheet was vacuum molded to form a packing container for pasteurizing.

For this product, the dart impact value is 700 g, the Vicat softening point is at 145°C, and the oxygen permeability is 100 cc/0.1 mm/m^2/day.